

REMARKS

Introduction

Claims 1-5, 8, 14-15, 17-20, 22-31 and 33-40 are pending in this application, with claims 1, 18 and 29 being independent. Claims 1, 8, 14-15, 18, 22-23, 29, 33, 35 and 36 have been amended to correct informalities in the claim language and to further clarify the present subject matter. Claims 2, 3, 5, 17, 19, 20, 24, 30, 31 and 37 have been canceled without prejudice or disclaimer of the subject matter thereof. Claims 41 and 42 have been added. Support for the amendment and the new claims is found, for example, at page 40, lines 3-4 of the specification and in the original claims. Care has been taken to avoid introducing new matter.

Claim Objection

Claim 1 was objected to because of minor informalities. Applicants respectfully submit that the amendment made to claim 1 overcomes this objection.

Rejection under 35 U.S.C. § 112

Claims 1-5, 8, 14-15 and 17 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Applicants respectfully submit that the amendments made to the claims overcome this rejection. In the amendment, the contents of the liquid and the solution have been clarified.

Claim Rejection - 35 U.S.C. § 103

Claims 1, 2, 5 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya (US 2002/0040522) in view of Hiraoka (US 2003/0022102). Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of

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Korleski (USP 5,753,358). Claim 4 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of Weege (Basic Impregnation Techniques). Claim 8 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of Claypoole (USP 2,164,764). Claims 14-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of Fukushima (US 3,483,283). Claims 18-19, 24 and 27-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of Schneble (US 3,799,816). Claim 20 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Schneble and further in view of Korleski. Claims 23 and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Schneble and Weege and further in view of Fukushima. Claim 26 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Schneble and further in view of Claypoole. Claims 29-30, 37 and 39-40 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and further in view of Echigo (US 2002/0029906) and Schneble. Claim 31 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Echigo and Schneble and further in view of Korleski. Claims 33-34, 36 and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Echigo and Schneble and further in view of Fukushima. Claim 35 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohya in view of Hiraoka and Echigo and Schneble and further in view of Weege. Applicants respectfully traverse these rejections for at least the following reasons.

Since claims 2, 3, 5, 19, 20, 30, 37 have been cancelled, the rejection of claims 2, 3, 5, 19, 20, 30, 37 is moot.

With respect to the rejection of independent claims 1, 18 and 29, Applicants respectfully submit that it would **not** have been obvious to combine Ohya with Hiraoka, because Ohya requires a heat treatment at 700 °C or more at which a porous resin of an expanded polytetrafluoroethylene base melts or degrades. The Examiner concedes that Ohya fails to disclose the claimed porous resin base, and relies on Hiraoka asserting that Hiraoka discloses the use of porous organic (i.e., resin) base. However, Applicants respectfully remind the Examiner that the asserted combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose (see, M.P.E.P. § 2143.01). As discussed below in detail, if polytetrafluoroethylene (i.e., a porous resin base) which has the melting point of 350°C or lower was used in Ohya's process which essentially requires a heat treatment at 700 °C or more, the polytetrafluoroethylene would melt or degrade, which would render the Ohya's process inoperable.

In Ohya, as disclosed in claim 1 of Ohya, "(2) fixing metal (M) to the penetration hole such that the metal (M) penetrates through the penetration hole" is an essential element. As a method for fixing this metal, Ohya discloses the following method at paragraph [0023]:

The method using a conductive paste comprises selecting, as the metal (M), a metal or alloy from gold, silver, copper, tin, nickel, and alloys of these metals, filling a hole with a conductive paste containing a powdery material of the metal (M) and an inorganic binder as essential components, drying and curing the binder at a low temperature of 90 to 250°C. and optionally decomposing an organic compound at a maximum temperature of 1,100°C. or lower.

Ohya discloses a heat treatments at 700°C or higher in all Examples as follows:

The substrate AN1-LSAg was maintained at 700°C. for 30 minutes, and then cooled to give a silver-through-fixed substrate (to be referred to as "AN1-Ag" hereinafter) (see, Example 1 of paragraph [0061]);

The substrate AN1-LSCu was maintained at 900°C. for 10 minutes, and then cooled to obtain a copper-through substrate (to be referred to as "AN1-Cu" hereinafter) (see, Example 2 of paragraph [0080]);

The substrate SZ1-d was maintained at 700°C. for 10 minutes and then cooled, whereby the rosin was completely removed and a cleaned hole-processed substrate (to be referred to as "SZ1-C" hereinafter) was obtained (see, Example 3 of paragraph [0089]);

The substrate AN1-LS-d on the alumina plate was placed in a nitrogen atmosphere furnace, temperature-increased from 200°C. to 700°C. at a rate of 8°C./minute, maintained at 700°C. for 10 minutes, and then cooled to remove the organic substance (see, Example 4 of paragraph [0093]); and

The substrate was maintained at 700°C. for 10 minutes and then cooled, whereby the organic substance was removed (see, Example 5 of paragraph [0101]).

Because of the high temperature treatment, Ohya utilizes ceramics which are tolerant of a high temperature treatment at 700°C or higher.

In contrast, it is well known that the melting point of polytetrafluoroethylene is 350°C or lower and a continuous service temperature thereof is ordinarily 270°C or lower. Thus, it is apparent that if polytetrafluoroethylene was used as a porous base of Ohya, the polytetrafluoroethylene would melt or degrade easily at such a high temperature of 700°C or higher, which would render the Ohya's process inoperable. As such, no one of skill in the art would be motivated to combine Ohya with Hiraoka because the combination would be inoperable. It is also clear that the remaining cited references do not cure the deficiency of Ohya regarding the porous resin base, and it would not have been obvious to add this feature to any combination of the cited references. As such, it is clear that claims 1, 18 and 29 and all claims dependent thereon are patentable over the cited references.

Further, Applicants respectfully submit that it would not have been obvious to apply a mechanically perforating method disclosed by Ohya to the porous resin base disclosed by Hiraoka. Hiraoka discloses the prior art of perforation for forming a via hole as follows:

In the first step, a via hole is formed in an insulating body by a photolithography process using a photosensitive polyimide or resist (see, paragraph [0010]).

In another method of the via formation, a via hole of a predetermined size is formed in an insulating body by using a drill or a CO₂ laser, followed by applying plating to the via hole or loading a conductive paste in the via hole (see, paragraph [0011]).

As described above, Hiraoka discloses a photolithography process or a process using a drill or a CO₂ laser as to the prior art of perforation for forming a via hole. However, as to the prior art of perforation for forming a via hole, Hiraoka discloses a drawback of the photolithography process as follows: “the via formation is laborious and it is difficult to improve the yield.” (see, paragraph [0010] of Hiraoka). In addition, Hiraoka discloses a drawback of the process using a drill or a CO₂ laser as follows: “[i]n the method utilizing formation of a via hole in an insulating body, however, it is difficult to form freely a fine via not larger than scores of microns in a desired position” (see, paragraph [0011]).

Further, Hiraoka discloses a method for forming a via, in which “a compound having hydrophilic radicals is allowed to permeate the pores of a three-dimensional porous film such as a PTFE film. Under this condition, the three-dimensional porous film is selectively exposed to light in a pattern by using a low-pressure mercury lamp having wavelengths of 185 nm and 254 nm” (see, paragraph [0012]), and a method for forming a via, in which “the entire surface of an insulating body made of a porous material is impregnated with a photosensitive composition containing a photosensitive reducing agent, a metal salt, etc., followed by applying an after-pattern light exposure so as to reduce the cation of the metal salt in the light-exposed portion into a metal nucleus. Then, the photosensitive composition in the unexposed portion is removed by washing, followed by applying electroless plating or soldering to the residual metal nuclei so as to form vias of a predetermined pattern” (see, paragraph [0014]).

However, the former method has a drawback in that “it is impossible to form a fine via” (see, paragraph [0013]), and the latter method has a drawback in that “[t]he abnormal precipitation of the metal nuclei gives rise to a problem in the insulating characteristics between the adjacent vias and between the adjacent wiring layers in accordance with miniaturization of the pattern” (see, paragraph [0015] of Hiraoka).

In view of such prior art, Hiraoka reached an invention relating to a method of manufacturing a composite member having a conductive pattern, comprising:

- (1) forming on a surface of an insulating body a photosensitive layer containing both a photosensitive compound forming an ion-exchange group or causing an ion-exchange group to disappear upon irradiation with an energy beam and a crosslinkable compound having a crosslinkable group;
- (2) forming a pattern of ion-exchange groups by selectively exposing the photosensitive layer to an energy beam so as to form an ion-exchange group in the exposed portion or to cause an ion-exchange group to disappear from the exposed portion;
- (3) crosslinking the crosslinkable compound contained in at least the exposed portion of the photosensitive layer;
- (4) allowing metal ions, a metal compound, or a metal colloid to be adsorbed on the pattern of ion-exchange groups formed by the selectively exposing; and
- (5) forming a composite member having conductive pattern by depositing a conductive material on the pattern of ion-exchange groups having the metal ions, the metal compound, or the metal colloid adsorbed thereon using an electroless plating (see, claim 1 of Hiraoka).

It should be noted that Hiraoka discloses as follows:

In steps (1) to (4) as well as steps (5) and (6), as required, included in the manufacturing method of the composite member according to another embodiment of the present invention, it is unnecessary to employ troublesome treatments such as resist coating, etching and peeling of the resist. It follows that the manufacturing process can be simplified, compared with the conventional method of manufacturing a wiring board, in which a through-hole is formed by, for example, photolithography and a mechanical means” (see, paragraph [0261]. Emphasis added).

In short, Hiraoka describes advantages of the invention compared with “conventional methods” such as photolithography and a mechanical means. In other words, the invention of Hiraoka does not disclose the present claimed feature that “the plurality of perforations is formed by a mechanically perforating method or a method of etching by a light-abrasion method,” as recited by independent claims 1, 18 and 29 of the present application. In addition, the specific diameter of dot patterns (vias) in the Examples disclosed in Hiraoka is smaller than 100 μm (see, TABLES 7 to 15 of Hiraoka). It should be noted that the maximum diameter of dot patterns (vias) in Hiraoka is 70 μm .

As described above regarding Hiraoka’s disclosure, it is understood that Hiraoka seeks to form a fine via not larger than tens of microns. In other words, Hiraoka does not perceive any problem with forming a via larger than tens of microns.

As described above, in relation to the use of a drill or a CO₂ laser, Hiraoka discloses that “[i]n the method utilizing formation of a via hole in an insulating body, however, it is difficult to form freely a fine via not larger than scores of microns in a desired position” (see, paragraph [0011]). In short, Hiraoka only recognized a difficulty in forming a via hole not larger than tens of microns as a drawback of “a conventional method” such as a drill or a CO₂ laser.

As such, Hiraoka does not recognize the problems described in the present specification that “[w]hen a porous resin material (hereinafter referred to as “porous resin base”) formed in the shape of a substrate is perforated by a machine-working method, however, the base itself is deformed, the porous structure of edges and inner wall surfaces of perforations is collapsed, and burr occurs on opening portions of the perforations, so that it is extremely difficult to form perforations with high precision while retaining the porous structure” (see, page 3, line 23 to page 4, line 3 of the present specification), and “[w]hen the porous resin base is perforated by

irradiation of laser beams, peripheries of perforated portions are melted and deformed by heat, or the porous structure of edges and inner wall surfaces of perforations is collapsed” (see, page 4, lines 4-11 of the present specification). Hiraoka does not perceive any problem on the combination of the claimed features “the porous resin base is a porous resin base which is an expanded polytetrafluoroethylene base having a microstructure comprising fibrils and nodes connected to each other by the fibrils” and “the plurality of perforations is formed by a mechanically perforating method or a method of etching by a light-abrasion method,” as recited by independent claims 1, 18 and 29 of the present application.

In other words, Hiraoka does not recognize an object of the present subject matter described in the present specification as follows: “It is an object of the present invention to provide a production process of a perforated porous resin base, by which perforations (through-holes) having smooth edges can be formed at necessary positions of a porous resin base with high precision without incurring collapse of the porous structure, deformation of the base and occurrence of burr” (see, page 15, line 24 to page 16, line 3 of the specification).

Accordingly, since one of ordinary skill in the art does not recognize any problem from the viewpoint of development of the perforating technique in the expanded polytetrafluoroethylene base, one of ordinary skill in the art cannot utilize a mechanically perforating method of Ohya in a process of perforating the expanded polytetrafluoroethylene base.

Applicants also note that Korleski, Weege, Claypoole and Fukushima do not disclose or suggest anything about perforation. Although Schneble appears to disclose perforation (see, column 3, lines 18-21), Schneble does not disclose “an expanded polytetrafluoroethylene base.” Schneble discloses as follows:

Among the organic resins which may be used to form the insulating bases described herein may be mentioned thermosetting resins, thermoplastic resins and mixtures of the foregoing.

Among the thermoplastic resins may be mentioned the acetal resins; acrylics, such as methyl acrylate; cellulosic resins, such as ethyl cellulose, cellulose acetate, cellulose propionate, cellulose acetate butyrate, cellulose nitrate and the like; chlorinated polyethers; nylon; polyethylene; polypropylene; polystyrene; styrene blends, such as acrylonitrile styrene co-polymers and acrylonitrile-butadiene-styrene copolymers; polycarbonates; polychlorotrifluoroethylene; and vinyl polymers and co-polymers, such as vinyl acetate, vinyl alcohol, vinyl butyral, vinyl chloride, vinyl chloride-acetate co-polymer, vinylidene chloride and vinyl formal.

Among the thermosetting resins may be mentioned allyl phthalate; furan; melamine-formaldehyde; phenol formaldehyde and phenol-furfural co-polymer, alone or compounded with butadiene acrylonitrile co-polymer or acrylonitrile-butadiene-styrene co-polymers, including such co-polymers by themselves; polyacrylic esters; silicones; urea formaldehyde; epoxy resins; allyl resins; glyceryl phthalates; polyesters; and the like (column 4, lines 22-47 of Schneble).

As such, it is clear that Schneble fails to disclose the above identified featured of the present claims.

Echigo also does not disclose "an expanded polytetrafluoroethylene base." Echigo discloses as follows:

"An example of film 101 will be named. For example, "KAPTON" (Du Pont-Toray trademark), "UPILEX" (Ube Industries Ltd. trademark), "APICAL" (Kaneka Corporation trademark) are named as film 101 comprising polyimide film. With these products, water-absorbing capacity may be selected by modifying the kind of the products and film of low water-absorbing power is also available. For example, "Aramica" (Asahi Chemical Industry Co., Ltd. trademark), "MICTRON" (Toray Co., Ltd. trademark) and "Technora" (Teijin Ltd.) are named as film 101 comprising aramid film. These aramid film is higher in rigidity and more resistant to stretching compared with polyimide film. For example, "Zylon" (Toyobo Co., Ltd. trademark) is named as film 101 comprising poly(p-phenylene benzobisoxazole) film. This film has heat-resistance, high elasticity and low water-absorbing power. For example, "Vectra" (Poly Plastic trademark) is named as film 101 comprising total aromatic polyester base liquid crystal polymer. This film is less in heat-resistance but less in water-absorbing and better in a dielectric characteristic (see, paragraphs [0044]-[0047] of Echigo).

As such, it is clear that Echigo fails to disclose the above identified featured of the present claims.

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Based on the foregoing, it is clear that the cited references, taken alone or in any combination thereof, do not render the present claims obvious. Accordingly, it is requested that the Examiner withdraw the rejections of the claims under 35 U.S.C. § 103(a).

Double Patenting

Claims 1-5, 8, 14-15, 17-20, 22-31, 33-40 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-13 of co-pending Application No. 11/660,993 in view of Ohya. Although Applicants disagree with the Examiner, in order to expedite the prosecution of the present application, Applicants are submitting a terminal disclaimer herewith. Accordingly, in light of the terminal disclaimer, Applicants request that the Examiner withdraw the double patenting rejection of claims 1-5, 8, 14-15, 17-20, 22-31, 33-40 based on Application No. 11/660,993.

New Claims

Since new claims 41 and 42 depend upon claim 1, and none of the cited references discloses the subject matter of these claims, claims 41 and 42 are patentable over the cited references.

Conclusion

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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